

produce no material of diagnostic quality, a solitary lung nodule still must be considered potentially malignant. The patient's age and clinical situation will dictate if an open biopsy or interval x-ray studies of the chest alone will be necessary.

DAVID C. RAUSCH, MD

REFERENCES

- Collins VP, Loeffler R, Tivey H, et al: Observations on growth rates of human tumors. *Ann J Roentgenol Radium Ther Nucl Med* 76:988-1000, Nov 1956
- Jereb M, Sinner W: The use of some special radiologic procedures in chest disease. *Radiol Clin North Am* 11:109-123 Apr 1973
- Steele JD: *The Solitary Pulmonary Nodule*. Springfield, Charles C Thomas, 1964

The Importance of 2,3-Diphosphoglycerate in Regulation of Tissue Oxygenation

THAT TISSUE OXYGENATION is dependent on more than just the arterial oxygen tension (PaO_2) and oxygen saturation is abundantly clear. The patient may have an excellent PaO_2 and oxygen (O_2) saturation, and yet have inadequate oxygenation at the tissue level due to a reduced hemoglobin (for example, reduced oxygen carrying capacity or O_2 content secondary to anemia). Oxygen delivery is as dependent on cardiac output as on O_2 content. The patient in shock may suffer from a tissue oxygen deficit due to inadequate tissue perfusion.

Another factor recognized many years ago is that the O_2 dissociation curve (relationship of O_2 saturation to PaO_2) may be shifted to the right or to the left. A shift of the curve to the right results in improved oxygen delivery by decreasing hemoglobin's affinity for O_2 . A shift of the curve to the left increases hemoglobin's affinity for O_2 resulting in impaired O_2 release to the tissue. Those factors which shift the curve to the left include hypothermia, hypocapnia and alkalosis, while fever, hypercapnia and acidosis result in a rightward shift of the curve. Certain congenital hemoglobins may present with either increased or decreased affinity for oxygen.

A red cell phosphate enzyme, 2,3-diphosphoglycerate (2,3-DPG), has recently been shown to be an important factor regulating tissue O_2 delivery.

An increased 2,3-DPG level decreases hemoglobin's affinity for O_2 , resulting in improved release of O_2 at the tissue level. A reduction in 2,3-DPG has the opposite effect. Factors resulting in an increased 2,3-DPG include hypoxia, anemia and thyrotoxicosis. Blood preserved with acid citrate dextrose (ACD) preservative loses up to 50 percent of its 2,3-DPG within 72 hours. If this blood is transfused, the hemoglobin will not release O_2 to the tissue properly because the O_2 dissociation curve is shifted to the left, an effect lasting up to 24 hours. Citrate phosphate dextrose (CPD) preserved blood, however, maintains 2,3-DPG levels much more effectively for two to three weeks.

P_{50} is a term now being used to indicate if the O_2 dissociation curve is shifted. Normal P_{50} (the PaO_2 when the O_2 saturation is 50 percent) is approximately 26.5 mm of mercury. An increased P_{50} would indicate a shift of the curve to the right.

The patient-care team should take all of these factors into consideration when evaluating the adequacy of tissue oxygenation. For instance, correction of alkalosis in itself will improve O_2 delivery to the tissues.

JOHN E. HODGKIN, MD

REFERENCES

- Finch CA, Lenfant C: Oxygen transport in man. *N Engl J Med* 286:407-415, Feb 1972
- Klocke RA: Oxygen transport and 2,3-diphosphoglycerate (DPG). *Chest* 26:79-85, Nov 1972

Rifampin in the Treatment of Tuberculosis

RIFAMPIN (United States Adopted Name) or rifampicin (World Health Organization nonproprietary name) has proven to be a very effective addition to the list of antituberculosis agents. A semisynthetic derivative of an antibiotic recovered in 1957 by Italian researchers from a strain of *Streptomyces mediterranei*, rifampin has been shown to have a wide range of biologic activities in such diverse life forms as viruses, bacteria and mammals. When combined, isoniazid and rifampin have a remarkable ability to kill *Mycobacterium tuberculosis*, and to sterilize infected tissues in animal models. Trials in man have shown that the combination of isoniazid and rifampin is at least as effective as any previous combination of agents used, and has the added advantage of excellent patient tolerance. Rifampin in combination with other antituberculosis agents has proven highly effective in both short-course treatment